THE MODEL ENGINEER

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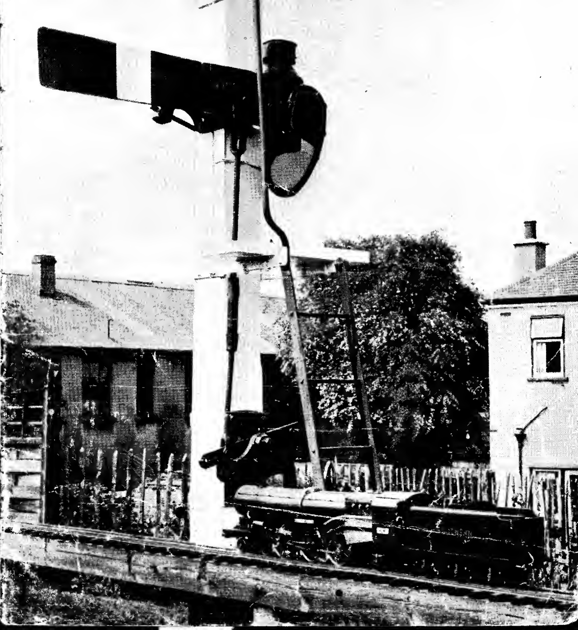
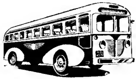


The MODEL ENGINEER

Percival Marshall & Co. Ltd., 23, Great Queen St., London, W.C.2

17 JULY 1947



VOL. 97. NO. 2408

SMOKE RINGS

Our Cover Picture

QUITE a number of railwaymen have, on retirement, kept up their interest and affection for "the old job" by building and operating a small railway; but we believe the case of a full-sized signal retiring from active service, to take up a similar job on a little line, is unique. Our illustration, taken by Mr. C. J. Grose, shows the ex-L.B. & S.C.R. signal which for many years regulated shunting operations at Coulsdon station, now acting as a "main-line board" on "L.B.S.C.'s" well-known "Polar Route." Being adjacent to the S.R. Brighton main line just south of Purley Oaks station, it has aroused considerable interest among regular passengers, as to how it came there, and what it is doing; and one "full-size" railway journal has been receiving queries on the subject! "L.B.S.C." took the ring off the arm, reconditioned the mechanism, and is now fitting up an arrangement for automatic working, on a similar system to that used on the London "Underground"; he will doubtless explain in due course how it was done. To add the "modern touch," he proposes to install an automatic colour-light "distant" at the opposite side of the line, working in conjunction in the approved manner. The old signal was familiar with the full-sized L.B. & S.C.R. single-wheeler 326 "Grosvenor"; when it sees "L.B.S.C.'s" little reincarnation approach for the first time, we can well imagine it exclaiming, "My word—ain't she shrunk!"

Men Like Ourselves

I HOPE my readers have been interested in the article on the life story of Sir Charles Parsons, which, in our issue of June 26th, formed the opening instalment of a series entitled "Men Like Ourselves" from the pen of Mr. Wilfred L. Randell. These articles, which will appear at occasional intervals, have a two-fold interest for model engineers. In the first place they will illuminate the progress of science and invention through the work of famous pioneers in this field, and in this sense will be of interest to those of the younger generation to whom these names and inventions may not be as familiar as they deserve. Secondly their life-stories will show how definitely these masters of mechanics have been like our own readers in their urge for creative handicraft and the application of their skill, often with very primitive equipment, to the advancement of technical knowledge. They have, in fact, been the model engineers of their day, and truly "men like ourselves." Mr. Randell is well known as a scientific historian and has the happy ability to clothe the dry-bones of historic record with the human qualities of his subject in charmingly readable fashion. But he is a model engineer himself who specialises in the fields of electrics and horology, and can therefore write with a sympathetic understanding of the view-point of his MODEL ENGINEER readers. These articles will, I hope, do more than provide some pleasant reading; they may inspire the latent genius of our more talented readers to

assert itself, and perhaps lead to some of them in the years to come figuring in this series not merely as men *like* ourselves, but more definitely as men who *are* ourselves, for who can tell which model engineer of today may not become the distinguished scientific leader or discoverer of tomorrow.

The Night Before

I WANT to make an appeal to those who may be bringing models or other items for the competition or loan sections of our Exhibition, particularly on the afternoon or evening of the day before the show opens. It is that they should not bring their wives and families with their models on the assumption that the occasion is one for a privileged pre-view at the Exhibition. While we are glad to welcome friends and relatives during the normal opening hours, the period of final preparation is one of considerable congestion of the contractors' work people, painters and stand fitters, of the trade firms unpacking and arranging their exhibits and of our own stewards receiving and staging the competition and loan models. To have private parties of friends and families wandering around sight-seeing during these very busy hours, is a source of much hindrance and embarrassment to those who have work to do, and we should be glad to be relieved from this additional source of confusion and unintentional obstruction. It may of course be necessary in some cases to bring a friend to assist with the transport or erection of a heavy or bulky exhibit, and there would be no objection to this. But the rest of the family must await their opportunity of seeing the wonderful models in patience, and remember that the job of completing and arranging this very elaborate show is one for those immediately concerned with the work, and who want to get on with it without pushing their way through a crowd of interested but uninvited onlookers.

Steam Scores Again

DURING the recent period of a national cut in fuel and power, I received another story of a steam-engine coming to the rescue of a small engineering workshop, which was faced with the prospect of a full stop. Mr. Gordon Green, of Hayes, tells the tale as follows :—" I was rather interested in your note 'A model to the rescue,' and you may like to know that we had a similar experience. As it became apparent that the cut was likely to be of longer duration than at first suggested, I started to look round for an alternative method of lighting our workshop, also of running at least a small lathe, so that we could keep some sort of production going. Petrol engines, gas and oil were all considered, together with fitting the lathe with a treadle. However, these were all out of the question for one reason or another, petrol was unobtainable, we had no gas supply in the workshop, and no assurance that this would not be cut too, and to fit the lathe up with a treadle would take some time and not solve the lighting problem. However, on looking through the advertisement columns of THE MODEL ENGINEER for a considerable period back, I came across a local advertisement offering a steam-engine and boiler. I promptly 'phoned the advertiser in the hope that this had not been sold, and that it would be large enough to do the job. Good fortune seemed to be favouring us for it was not sold, but on seeing it, I feared it would be too small to do all we wanted. It was taken up to the shop, and temporarily assembled, steam raised and duly turned on, only to find that the engine would not develop enough power to drive its own feed-pump. It was stripped down and we discovered that the piston was a hopeless fit, and the rings badly rusted ; further, the ports were obviously not made by a follower of 'L.B.S.C.', so the engine, an old-type vertical, very substantally built, $1\frac{1}{2}$ in. bore $\times$ 2 in. stroke, was completely 'L.B.S.C.ised.' On assembly it exceeded our expectations ; at 60 lb. pressure it just walked away with the lathe, using very little steam and the water-pump which before would not keep up the water level owing to the extravagance of the engine with steam, could not be left on long before the water was up the glass. An old car dynamo was then harnessed to it as well as the $3\frac{1}{2}$-in. lathe, and to our surprise it kept both going O.K. The fuel was a mixture of coal-dust, coke and wood shavings. Thus we were able to keep up production, although on a reduced scale. The engine still stands ready should need for it to be called into service arise again. One rather humorous incident happened. I was there alone one afternoon with my young son, aged six, when the telephone-bell rang, and I had to go into another room to answer it ; the caller kept me some considerable time, and my son went to have a look at the boiler. He came back in a panic, 'Daddy, shall I open the fire-door ? The workshop is full of steam and the boiler is hissing.' Now I had not tested the boiler as we had intended to do at the first possible moment, so I went dashing through to find the pressure-gauge hard over (120). The working pressure was 60, and the safety-valve blowing off well, so I let the fire down at once, and got to work on the hand-pump. I did not consider it necessary to test the boiler after this, but, of course, realised that the safety-valve area required enlarging. Needless to say, the local model engineers soon got to hear about our way of overcoming the difficulty, and we had quite a number of callers, who came along to make enquiries for things in which it is very doubtful whether they were really interested—they wanted to see a model steam engine actually in action on 'a real job !' "

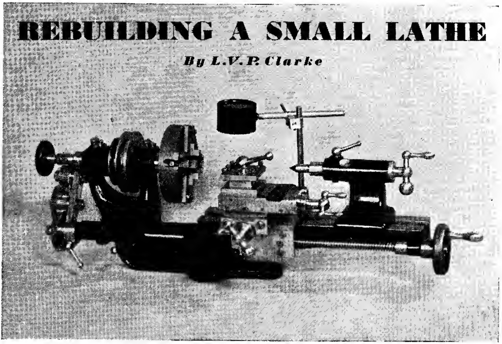
A Club for Fareham

IN March last a club was formed for Fareham and district and has now attained a membership of close on forty. The interests so far are particularly related to power boats, race cars and aircraft ; facilities for running boats are available in Fareham Creek, and indoor model flying and car racing meetings are held in the Belgrave Hall, West Street, Fareham. The next meeting will be held on July 28th, when visitors will be cordially welcomed. The Hon. Secretary is Mr. A. May, 'Fairway' Bath Lane, Fareham, Hants.

Percival Marshall

REBUILDING A SMALL LATHE

By L.V.P. Clarke



MANY years back, having no fixed abode—and means of support not too visible either—a "Super Adept" lathe was purchased at a price which even for those times was incredibly low. However, it did all that was expected of it, and while the finish and fit was not all that could be desired for precision work, the greater part of the chassis for an "O"-gauge steam loco. was successfully machined as well as many other small jobs, and there is no doubt that the lathe was real value for money (usual disclaimer).

On becoming interested in the repair and restoration of old watches and clocks it began to be felt that something a little more accurate would help. Unfortunately, by this time lathes were selling for about their weight in gold, even if they could be obtained, so after much thought it was decided the only thing to do was to rebuild the "Adept" into a proper watchmaker's lathe, but at the same time keeping in mind that other jobs may come along where screwcutting would be useful. The improvements have well paid for themselves, as already about a dozen watch balance staffs have been produced and many winder stems and similar parts. In addition to coping with these, the improvement in fit everywhere has greatly increased the rigidity of the slides, enabling cast-iron up to $2\frac{1}{2}$-in. dia. to be turned with ease and $\frac{1}{2}$-in. dia. mild steel parted off with—to quote "L.B.S.C."—a noise like bacon frying.

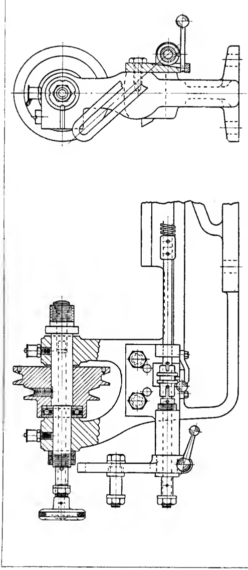
One of the first jobs was to fit a 4-tool turret, as, having no other machine tool, as much work as possible had to be done on the lathe itself and time wasted in changing tools had to be cut to a minimum. This turret was built up from three pieces of plate held together with four steel rivets and has a tiny spring-loaded plunger underneath, which while locating the turret with reasonable accuracy, does not prevent setting at odd angles for the occasional awkward job.

All the sliding surfaces were scraped up to a surface plate and in order to improve the guiding of the cross-slide, a new saddle was made having V's for the full width. This saddle was laboriously sawn out of a slab of cast-iron but well repaid the effort. The original gib strip was discarded and one of a more solid pattern fitted and the leadscrew nut was cut off and fixed to an apron. The cross-slide and top-slide were shortened by sawing off the tapered part and fitting a plate, while the screws were reduced in diameter to take micrometer collars and ball handles. Before final assembly all slides were lapped together with metal polish followed by a thorough wash in petrol. This gives practically 100 per cent. bearing to the faces and seems to do much towards adding rigidity.

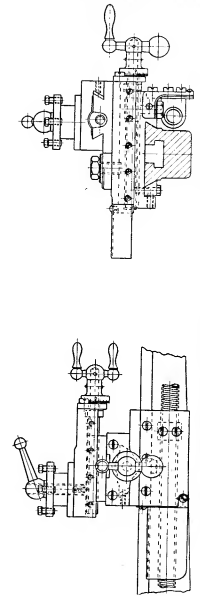
The next job was the swing-arm bracket and the extension to the leadscrew, all of which had to be completed before cutting the gears—in fact, the whole rebuilding had to be very carefully worked out and a "Schedule of Operation" (!) prepared so that a part would not be altered or scrapped before the replacement had been made. The swing-arm bracket was built up from $\frac{3}{16}$ in. brass plate and $\frac{1}{2}$-in. dia. round bar, the two being silver-soldered in the sitting-room fire, the unsightly groove where the round met the flat being camouflaged with soft solder. The end of the leadscrew was filed down to $\frac{3}{16}$-in. dia. and a small "snuff" coupling made with $\frac{1}{16}$-in. dia. taper pins to connect the silver-steel extension. Some filing

of the bed was necessary to take the bracket but no harm seems to have resulted. The swing-arm also was built up, the slotted part being $\frac{3}{16}$-in. brass, silver-soldered to a steel boss—an advantage in one way as it enabled the boss to be bored in the lathe, a job which would not otherwise have been possible owing to the length of the arm.

The mandrel was now reversed end for end, drilled up and tapped $\frac{1}{4}$ in. $\times$ 40 to take an extension stud to carry the pinion for screw-cutting. The gears were a real headache, as there seemed to be nothing available on the market of the requisite pitch. 50 D.P. was decided on as this will allow a $\frac{1}{4}$-in. dia. hole through a 20-tooth pinion, yet a gear of 120 teeth is not too unwieldy. The only thing seemed to be to make them, so tools were roughed out



Details of the headstock (*Scale half-size*)

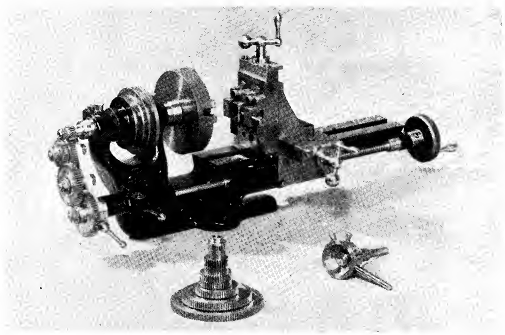


New saddle with modified cross slide and top slide (*Scale half-size*)

with the object of planing them in the lathe As luck would have it, just at this time I was able to obtain the use of an optical projector, so the finished tools were really accurate but it was a slow job stoning them by hand to shape. Consequently only three were made,

one covering 20, 25 and 30 teeth, one for 35 to 65 teeth and one for the 90 and 120 gears. Having no division plate a set of "Myford" gears were borrowed and each in turn bushed and mounted firmly on the extended part of the mandrel. A block bolted to the swing-arm held up by a spring wired to a bearing screw acted as the detent.

Everything was now set for the gear-cutting so blanks were sawn from the $\frac{3}{16}$-in. brass plate (alas, rapidly dwindling) bored and put on a mandrel in the chuck supported by the tailstock. small size of the "Adept" was an advantage as it was unbolted and gear-cutting continued in the sitting-room as near as it was possible to get to a large fire (those were the days!). The 20-tooth pinion, since it does more work than the other gears, was made in mild steel and as the new mandrel had not been fitted at this stage, cutting was very slow—however, it was eventually finished. No "Myford" gear was available for cutting 120 teeth by direct dividing, so a 60 gear was used, first going round the blank cutting every other tooth. The blank was then



revolved in relation to the "Myford" gear by the amount of one tooth—as near as could be judged under a powerful magnifying glass—and the remaining teeth cut. A 90-tooth gear was cut in a similar way using a 45 for dividing. Although not necessary for screwcutting these two gears give a fine feed of approx. 560 t.p.i. in a triple-compound train, a feed which has been found to be just right for long jobs in steel. With the lathe running at 800 r.p.m. the gear train can barely be heard above the hum of the driving motor, so the other crude method of dividing the larger gears cannot have been too inaccurate.

I forgot to mention that previous to this the same rig-up was used to divide the collars for cross-slide and top-slide into 50 as the cross-slide one was very necessary to get the correct depth of teeth—in this case 0.045 in. The first gear attempted was of 30 teeth, the tool on its side being traversed across the blank by the leadscrew, but as cuts of only 0.001 in. could be taken reducing to 0.0005 in. as the tool got deeper in, the net result of some hours of twisting was chronic "tennis elbow" and just one gear, while there were still hundreds of teeth to be cut! But still, since the job was "shaping," why not make the lathe into a shape?—so the screw was removed from the top-slide and a con.-rod and lever rapidly made up from $\frac{1}{8}$-in. hoop-iron, the lever pivoting on a bolt in the "T" slot of the bed. After a bit of practice at advancing the tool 0.001 in. for each stroke of the lever the improvement was astonishing, a 60-tooth gear taking only an hour to cut.

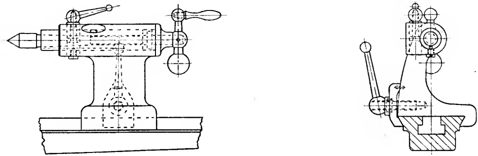
About this time the weather took a hand in things and workshop temperature couldn't be coaxed above freezing point. However, the

A ball thrust was considered essential for the new mandrel and the front bearing required opening out, as I had in mind a hollow mandrel to take collet chucks. The most the casting would stand was a $\frac{7}{16}$-in. dia., leaving only a very small step to take the thrust, but the belt pulley helps to steady the race—and incidentally prevents the dirt getting in. To digress somewhat—as originally supplied the grooves for belt were 60-deg. included angle and nothing

would stop belt slip. As an experiment the new pulley was made with grooves as for a "V" belt, i.e. 38-deg. included and this definitely solved the slipping problem, the round belt after a little use taking up a perfect "V" form.

To return—the new mandrel was turned out of what was said to be nickel steel—at any rate it with the tailstock on the bed, the hole lapped to a mirror finish (much to my surprise). To ensure accuracy it was essential that the barrel should be turned and the taper hole for centre bored at the same setting, but since the barrel is 2⅛-in. long my good friend was called on again.

The barrel is divided in thirty-seconds of an inch as an aid to drilling, the divisions being seen



The tailstock (Scale half-size)

was pretty tough stuff and practically a maximum capacity job for the lathe. The 5/35-in. dia. centre hole couldn't be attempted so a friend kindly obliged and this hole was used to run on the centres for turning and screwcutting, the nose now being ½-in. B.S.F. I was lucky enough to get the headstock opened out on a jig-borer dead true with the bed, and the new pulley and other details having been already made, all could be assembled. There was not sufficient room to fit 6 mm. collets so a special size with 7/32-in. dia. shank was adopted and the taper bored with the mandrel in place.

The tailstock is of fairly normal design, being guided by the same ways as the saddle and clamped by a lever. Since iron castings were practically impossible to obtain at the time, the body was sawn out of a solid lump of scrap with much expenditure of high-speed steel hacksaw blades and a vast amount of perspiration (summer was then upon us !). Rough drilling of the hole for barrel was also beyond the lathe's capacity, but with this achieved the body was fitted to the bed and with a boring bar in the chuck, was pushed along by the saddle for final boring. Thus the accuracy was beyond doubt. Unfortunately, owing to the large overhang of the boring bar, chatter couldn't be avoided, so an expanding lead lap was made up and, still through a small "window" in the side of the body. The method of dividing may be of interest. The barrel was put in the chuck, the other end being supported by the old tailstock. First a longtitudinal groove was cut with a pointed tool in much the same manner as for gear cutting except that it was, of course, only a few "thou." deep. Then the tool was turned right way up and a zero mark made by running the tool in and pulling the chuck round a fraction of a turn. Using the micrometer collar on the top slide the tool was moved 1/32 in. along and another groove cut and so on, every fourth groove being made slightly longer than the rest and numbered one to eight.

The vertical slide was the last job to be done and a source of castings having been found, a pattern was made up for the angle portion. This was filed and scraped up in just the same way as the saddle. A standard cross-slide and screw were purchased from the makers of the lathe and amended to suit. The vice is quite straightforward and has been found most useful for holding small jobs for endmilling.

To finish, all castings were given one undercoat, followed by two coats of black cellulose, put on by brush. In spite of much advice received against such a practice, the results were surprisingly good.

A Model Theatre Exhibition

THE Annual Exhibition organised by The British Puppet and Model Theatre Guild will be held at Victory House, Leicester Square, London, W.1, from October 13th to the 25th. The exhibits will include everything relating to model theatres, scenic designs, marionettes, and glove puppets. Demonstrations will be given during the course of the show, and several Cups are on offer in the different classes. Entry forms and full particulars may be obtained from the Hon. Secretary, ANN BUSSELL, "Wood View," Hadley Highstone, Barnet.

WORKSHOP LESSONS

by "Morse Taper"

THE following are a few of the lessons which I learnt as manager of a small motor engineering firm while engaged in the machining of aircraft and similar small parts. I hope they may be of some interest to those of your readers who have only recently entered the brotherhood of small lathe users.

In purchasing a lathe, and, indeed, almost any machine tool for jobbing work, I have found that it pays to obtain a slightly larger tool than will be absolutely necessary for any job which I may have to tackle, as, apart from the wider range of work which may be carried out, the increased bearing surfaces and general rigidity make for long life and for ease in carrying out such operations as intermittent cutting, deep grooving and parting-off. A lathe having as large a bore as possible in the hollow spindle is also a great advantage when working with bar material, saving endless time and sweat to those not possessed of a power saw.

Second-hand Lathes

When buying a second-hand lathe the wear at the cross-slide nut is generally a fair indication of the amount of use to which the machine has been put, and I think that this is a well-known fact to many of the dealers in machine tools, as I have frequently had my attention drawn to the absence of wear at this point, only to find, on further examination, that the nut has been renewed, but nothing else!

The use of ball-bearing plummer blocks on shafting, I think, is a great advantage, as one has not to be forever going around with an oil-can before starting up—attention about once a year is all they need.

Parting-off

Amongst the many trials and tribulations which beset the would-be turner, I would place parting-off. My best results have been obtained by grinding a good lip on the tool (for steel), running at a medium speed, increasing speed as diameter is reduced, using plenty of suds and endeavouring to keep a steady pressure on the tool, which should be at centre height, and as thick as is consistent with economy of metal. With a little practice one can soon get the feel of the tool and know when to ease off a little.

Another trouble has been chatter when using a large radius or broad-faced tool, and some lathes *will* chatter, no matter what is done to stop them. In my opinion, this is due to lack of weight to absorb the tool vibrations in the headstock and saddle, and little can be done to effect a cure.

On the average lathe, however, attention to the spindle bearings, slide rest gibs, and tool and work support, is generally sufficient. If the bearings cannot be tightened, a little heavy-grade engine oil is a help.

Cutting Screw Threads

The cutting of screw threads to Air Ministry limits was of some trouble to me at first, and the following was the method of cutting accurate threads, when gauges were not available. Turn the work to the major thread diameter, +.000 in., − .001 in. Cut thread direct with chaser until major diameter is on original size. This method is, of course, only applicable to non-ferrous metals, and to mild-steel up to about 1 in. diameter. In special steels or larger diameters, a single point tool must first be used. Incidentally, before attempting to chase a thread it is advisable to check the chaser with a thread gauge, as, although the average chaser is extremely accurate. there are occasional black sheep, out of pitch. It is also most important that the chaser be set exactly at right-angles to the centre-line of the work; a good test is to run in the chaser until the points just touch the revolving work, when any error in angle is easily seen and may as easily be corrected.

For slide-rest tools I use H.S. tool bits, which I find much more economical than forged tools, as their initial cost is low, they can be ground and reground, until too short for further service (after which they can often be used in small boring bars), also no re-hardening is necessary if reasonable care is exercised in grinding to prevent overheating. The commonest fault in re-grinding is to grind off far more than is necessary.

Tipped Tools

Carbide-tipped tools can be used to advantage for long runs of work when frequent re-grinding is to be avoided, but I am doubtful if they are worth while, for the model engineer.

When a tool digs in, particularly a carbide tool, it may be saved from chipping by slackening the holding screws, thus allowing the nose of the tool to fall clear of the work.

When turning aluminium castings, the tool should be given what looks to the average amateur an excessive amount of top rake; this prevents the cuttings building up on the tool point, which is the biggest trouble with this metal.

I have found revolving lathe centres a great help both for heavy and light work, they prevent distortion of the work through overheating, and also retain the centre hole in the condition in which it left the drill, which can be a great advantage for future operations, such as finish turning and grinding.

No doubt the skilled turner will have one or two smiles if he reads the above, but my excuse for these remarks is that "Nobody told me," and so, perhaps, there are some others who will not have the same excuse.

A PORTABLE LATHE STAND

by R. Bolton

HAVING purchased one of the excellent *ex*-R.A.F. fitters' benches, recently advertised in this paper, a description of its conversion to a lathe bench may be of interest. To begin with, I must explain that I have to do all my work sitting down, which accounts for the somewhat lengthy procedure in making.

The bench being duly delivered, a start was made to remove the thick layer of grease with which the R.A.F. appear to take delight in plastering all their equipment. Having done this, the "War Paint" was found to be in sound condition; it was necessary to lower the bench some 9 in. so as to bring the lathe centres as low as possible, bearing in mind the necessity of being able to get the legs underneath.

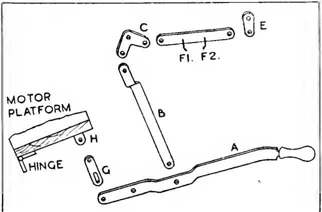


Fig. 1. *Switch gear*

In their original state these benches have two wheels at one end to enable them easily to be moved about simply by lifting the other end. As I wished to retain this semi-portable feature, I realised this arrangement would not be suitable, being unable to lift the weight of the bench plus the equipment thereon, some form of "retractable undercarriage" near the centre was desirable, thus maintaining a state of balance, and at the same time moving in a smaller arc. This was easily accomplished, as on shortening the legs, approximately 4 in. of angle remained complete with axle, bushes and wheels, it only being necessary to shorten the former sufficiently to enable it to be mounted inside the bottom frame, the position of which had been altered to within $\frac{1}{16}$ in. of floor level, the struts having been re-positioned, also $\frac{3}{8}$ in. holes were drilled at dead-centre of this frame, axle shortened and bolted up with distance pieces between and a similar hole bored in the lug of the cross-member. A glance at the photographs and drawings will explain the workings of this lowering mechanism; suffice it to say a weight of 12 stone was easily lifted and moved about. The above arrangement brings the wheels 4 in. off-centre, which evens up the load when the lathe and countershaft are mounted, the greater weight being at the

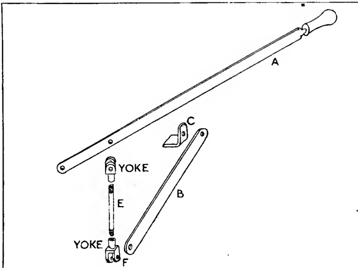


Fig. 2. *Bench raising mechanism*

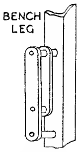
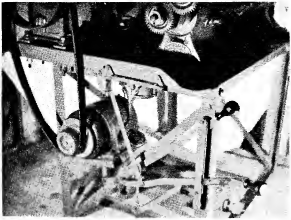


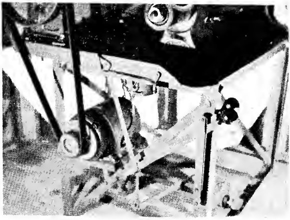
Fig. 3. *Gate*



Photograph No. 1

the headstock end. The lever, Fig. 2, was then tied down, making the bench mobile for further work. So much for the "Undercart."

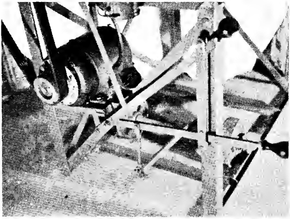
I have always felt sorry for the small motors we amateurs use, which, on being switched on, have (in the words of our good friend "L.B.S.C.") to move all the "words and music" *i.e.*, countershafts and lathe, with possibly a drill and grinder, flat-out on the word go! Imagine a car being started in top gear, accelerator hard down and all the family inside all in a split second; the agony of its internals can almost be felt. I had determined to alleviate this suffering, and, although the fast-and-loose pulley arrangement does, in a way, minimise the shock by allowing the motor to build up its revs., nevertheless, there is still much to be desired; some form of clutch was, therefore, indicated.



Photograph No. 2

The drawings show how this is accomplished; briefly the operation is as follows:—On lever "A," photograph 1 (this photograph also shows the undercarriage in the lowered position), being depressed to the bottom of its stroke, the motor is raised by link "G," at the same time the lever "B" through the bell-crank "C" and the connecting-rod pushed forward, the switch trip "F.1," thus switching on with the belt slack. The lever "A" is then slowly brought to the position occupied in photograph 2, the drive being gradually taken up, belt tension maintained by the weight of the motor itself. It will be noticed in this photograph, this lever is not quite at the top of its stroke, in which position, photograph 3, the motor is switched off by the trip "F.2," Fig. 1, no further tension being applied to the belt on account of the slot in the link "G"; the switch, incidentally, is a standard "Crabtree" Ironclad. One further point. The outer strip in the gate, Fig. 3, is slightly bowed inwards to grip this lever when in the lowered position. This arrangement has to be used to be appreciated, being a joy to work, especially when screw-cutting, as you can "creep" up to that awkward shoulder with ease, press the lever down and the lathe can be stopped instantly, bring it straight up and she is switched off. The trips "F.1 and F.2," being only 20-gauge mild-steel can easily be bent to allow for belt stretch, which is not very great. I have had this arrangement running for many months now without any adjustment being necessary.

In conclusion, although no dimensions are given, no drawings having been prepared at the time of conversion, "Trial-and-Error" being used, I shall be pleased to let any interested readers have them should they so desire.



Photograph No. 3

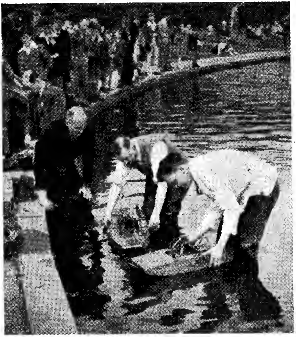
THE BOURNVILLE REGATTA

THE Bournville Model Yacht and Power Boat Club held their regatta at the Whitsuntide week-end, and the events opened in a light south to south-west variable breeze, when models of the six-metre class raced for the Harry Hackett Championship Cup. It needed skill and much re-trimming of sails to show any superiority in navigation: and points were well deserved. The cup was won by "Dare," skippered by John Lewis.

Second was "Mischief," N. Powell.

Third was "Thelma," H. C. Hall.

The next competition was for the Walter Edwards Shield, and for this the competition was raced by the 36-in. class. Similar conditions called forth the ability of the yachtsmen and resulted in close finishes. The winner was "Brota," W. H. Ray, followed by "Eros," R. Smith; third, "Mickey" and "Ariel," owned by B. Jones and D. Turner respectively, who tied.



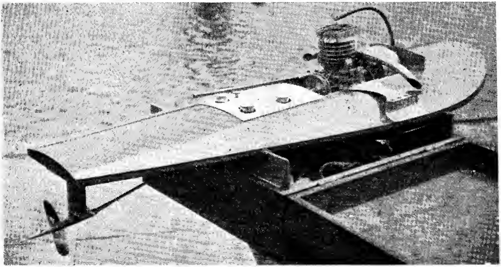
Tuning up boats before the Class A racing event

Whit-Monday was devoted to open events for speed and steering. Entrants were from Bournville, Altrincham, Blackheath, Coventry, Darley Abbey, Derby, Littleover and Victoria (London).

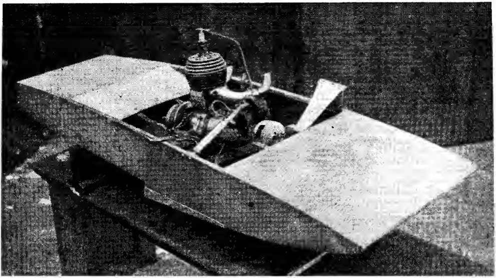
Results :—

Class A. Hydroplanes, 30 c.c. (Bournville Coronation Speed Trophy): 1, K. Williams, Bournville (Faro), 30.33 m.p.h.; 2, W. Tomkinson, Altrincham (A.30), 27.97 m.p.h.; 3: A. J. Bills, West Midland Club (Ann), 20.4 m.p.h.

Class B. Hydroplanes, 15 c.c. and a flash steam hydroplane: 1, W. Tomkinson (Bea), 28.5 m.p.h.;



An interesting new 15-c.c. boat by Mr. T. Dalziel, with 15-c.c. flat-top two-stroke and flywheel magneto

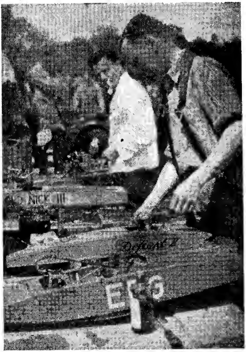


Mr. W. Tomkinson's 30-c.c. boat ("Atom V" engine) with magneto ignition, a consistent performer in the A class event

2, H. Wraith, Altrincham (Mrs. Frequently), 20.4 m.p.h.; 3, A. Benson, Blackheath (Erg), flash steam boat, 15.7 m.p.h.

Steering: 1, Flight-Officer Williams (No Name), 10 points; 2, J. Harlow, Bournville (Lady Ann), 6 points.

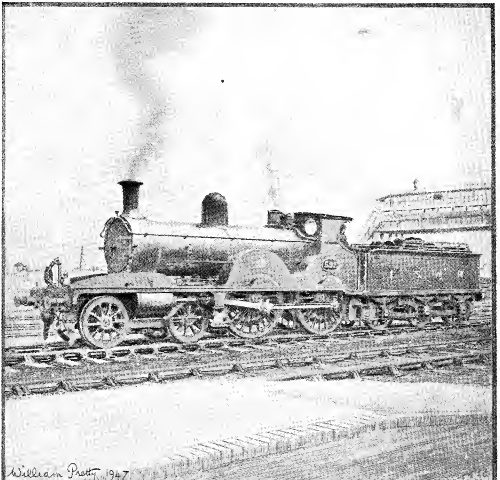
In the absence of the Commodore, G. Beale, the Vice-Commodore, W. H. Ray, presented the prizes, and all agreed that the club had been highly successful in yet another regatta, giving pleasure and interest to members, to competitors and to the large crowd of the visiting public.



Mr. Cruickshank's "Defiant II," a promising but unlucky venturer in the 15-c.c. class speed boats

Mr. K. Williams, whose well known 30-c.c. speed boat "Faro" made its first post-war appearance

L. S. W. R. No. 592



THE recent withdrawal, by the Southern Railway, of the last Adams 4-4-0 type express passenger engine adds interest to the pencil-drawing reproduced herewith. The original of this illustration is the work of Mr. William Pretty, of Hendon; it was copied from a photograph supplied by the Locomotive Publishing Co. Ltd., and depicts Engine No. 592, which was designed by William Adams and built at Nine Elms in 1892 for express passenger work between London, Southampton, Bournemouth and Salisbury. No. 592 belonged to Class "X2," consisting of twenty engines, Nos. 577 to 596, the construction of which was begun in 1890 and finished in 1892. When new, these engines became widely known as "the most powerful express engines in the United Kingdom" and they won a considerable popularity. A few years later, however—in 1895, to be exact—they suffered at least a partial eclipse when Adams brought out ten very similar but greatly improved engines, Nos. 677 to 686, of Class "T6," which became known as the "Adams Fliers" and were, unquestionably, the finest of all Adams's creations. No. 592 and her nineteen sisters had cylinders 19 in. diameter by 26 in. stroke. The driving and coupled wheels were 7 ft. 1 in. diameter. The bogie-wheels were unusually large, being 3 ft. 9¾ in. diameter.

In Mr. Pretty's drawing, No. 592 is shown fitted with a Drummond cast-iron chimney instead of the former Adams "stove-pipe"; this alteration was made to all the engines of this class, in course of time. Certain other minor modifications were made by Mr. Drummond,

(*Continued on page* 72)

"L.B.S.C."

"JULIET'S" REGULATOR

As our simple little lady needs a simple little regulator, I have specified the disc-in-a-tube type, the Curly version of which is easy to make, gives good regulation, and keeps steam-tight. From time to time, various claims have been made for the "invention" of this; but they are all unwarranted, because I have here at the present minute a sectional drawing of a full-size locomotive built a hundred and ten years ago, when Queen Victoria ascended the throne of England, and it shows a regulator of this pattern! The difference is that there are four rectangular ports in the valve face and four similar openings in the disc, like the ventilators on what the old enginemen used to call "cookshop" windows. The stops were on the backhead, over the gland, and were rather clumsy. The regulator opened all-of-a-sudden-Peggy, as all four ports started to open at the same time; but it certainly allowed a full flow of steam to the cylinders, which was very necessary in those days, on account of the low boiler pressures used, the one in this case being 50 lb. only. When this type of regulator was applied to small boilers, it was adopted "lock, stock and barrel," using four round holes instead of rectangular ports, and retaining the ugly outside stops; it didn't give gradual admission, but, like its prototype, was "all or nothing." Your humble servant's version does away with both the outside stops and the non-regulating propensities; and this is how you can make one, suitable either for locotype or water-tube boilers.

Barrel and Valve

The barrel is a piece of $\frac{5}{8}$-in. brass triblet tube, squared off at both ends in the lathe to a length of 2 in. Ordinary copper or brass tube will also do, but it should not be thicker than 20-gauge. Drill a 7/32-in. hole in the middle, and tap it $\frac{1}{4}$ in. by 40 for the vertical steam pipe.

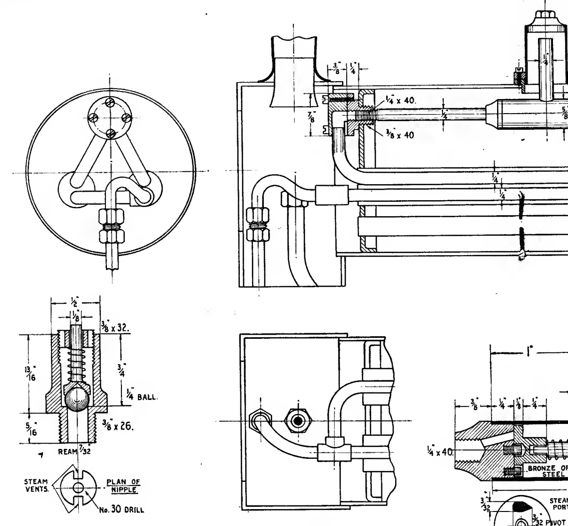
For the throttle-block, chuck a piece of $\frac{5}{8}$-in. round brass rod in three-jaw. Face the end, centre, drill $\frac{1}{8}$ in. depth with No. 48 drill, tap 3/32 in. or 7-B.A., and slightly countersink the hole. Turn down $\frac{1}{4}$ in. of the outside to a tight fit in the tube, and part off at $\frac{5}{8}$ in. from the end. Reverse in chuck, and grip by the turned part. Centre the other end, drill about $\frac{5}{16}$ in. depth with 7/32-in. drill, tap $\frac{1}{4}$ in. by 40, and turn the outside to the shape shown. Now be careful over the next bit: make two centre-pops a shade over 3/32 in. apart, on the turned face, not quite halfway between the edge and the centre hole, and drill them out on the slant, with a 3/32-in. drill, until it breaks through—not breaks off!—into the tapped hole, as shown in the longitudinal section. My usual practice is to do this job by hand, using a Millers' Falls hand-brace, with the drill projecting just far enough from the jaws, to drill the required depth. The block is held in the bench-vice at the necessary angle, and the brace held horizontally; a tip for beginners. Now, with a watchmaker's needle file, or an Abrafile, run the two holes into an oval slot, and with a small chisel, home-made from a bit of $\frac{1}{8}$-in. silver-steel, chip one end of the slot to an arrow-point, as shown in the illustration of the port face. The hole for the stop-pin is drilled No. 48, close to the edge, in the position of the hour-hand of a clock at 7.30; tap it 3/32 in. or 7-B.A. True up the port face exactly as described for the slide-valves, and screw in two little stubs of 3/32-in. round rod; bronze if you have it; if not, use brass.

Bronze rod is best for the valve, as dissimilar metals, unlike human beings, work best together, and a bronze valve will wear longer and remain steam-tight; but brass will do if nothing better is available. Chuck a piece of $\frac{5}{8}$-in. round rod in three-jaw, face the end, and turn down about $\frac{1}{2}$ in. length to an easy fit in the barrel tube. Further reduce $\frac{1}{4}$ in. length to $\frac{1}{4}$ in. diameter, and part-off at a full $\frac{3}{8}$ in. from the end. Reverse in chuck, centre, drill through with No. 40 drill, and countersink slightly. Take a truing-up skim off the face. Centre-pop and drill the port, same as on the port face, but leave the ends round. File a segment out of the opposite end, as shown, so that when the faces are in contact the port will be wide open when the pin is at one end of the gap, and completely closed, with about 1/32 in. overlap for safety, when the pin is at the other end. As the valve is moved from the "shut" position, the port in it first uncovers the arrow-pointed end of the steam port, and enables the engine to be started off with a heavy load, without making her slip by too sudden steam admission. Face the valve truly, same as the slide-valves, by rubbing lightly on a bit of fine emery-cloth or other abrasive, laid working face up, on the lathe-bed or any similar true surface. The faint scratches hold the oil. A slot 3/32 in. wide and a full $\frac{3}{16}$ in. deep, is milled, or sawn and filed, across the boss, to take the flattened end of the operating rod.

Chuck the $\frac{5}{8}$-in. brass rod again, and turn down about $\frac{1}{2}$ in. of it to a tight fit in the barrel tube. Centre, and drill $\frac{1}{2}$ in. depth with No. 20 drill. Open out to $\frac{1}{4}$ in. depth with 11/32-in. drill, and tap $\frac{3}{8}$ in. by 40. Part-off at $\frac{3}{8}$ in. from the end; reverse in chuck and skim off any burring around the centre hole.

Operating Gear

The regulator-rod is a piece of 5/32-in. rustless steel, nickel, phosphor-bronze or brass rod, cut to an overall length of $9\frac{3}{16}$ in. One end has two flats filed or milled on it, to form a tongue a bare $\frac{3}{16}$ in. long, which should be an easy fit in the slot in the boss of the valve. Turn down about 5/32 in. of the other end to 3/32 in. diameter, and screw it 3/32 in. or 7-B.A.; the 5/32 in. immediately behind it is filed square, to take the boss

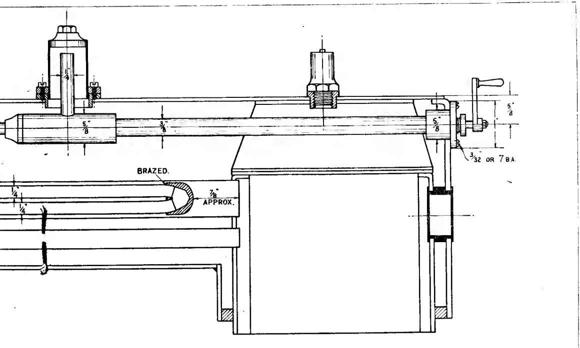


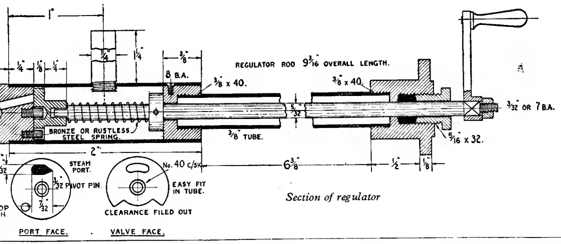
Safety-valve

"Juliet's" regulator and superheater

of the regulator-handle. Chuck a piece of ⅜-in. round brass rod in the three-jaw; face, centre, drill down about ¼ in. with No. 23 drill, and part off $\frac{3}{16}$ in. from the end. Drive this collar on to the tongued end of the regulator-rod at approximately 1 in. from the tip of the tongue.

Squeeze the throttle-block into the end of the barrel, with the steam-port at the top; that is, in line with the steam-pipe hole in the barrel. Put the valve in, insert the rod with the tongue in the valve slot, and push in the end plug flush with the end of the barrel. If the regulator-rod has about 1/32 in. end play, it is O.K.; if not, adjust the collar on the rod until you get that amount. If it has no play at all, it will jam the valve; and if too much, the valve will come off the face and leak. Pin the collar to the rod by drilling a No. 48 hole through it and the spindle, and driving in a bit of bronze or brass wire. Wind up a spring from a piece of 22-gauge rustless steel, bronze or hard brass wire, using a piece of 5/32-in. round rod, held in the three-jaw, as a mandrel. Bend one end of the wire at right-angles and poke it between the chuck-jaws, then pull the belt with your left hand whilst you guide the wire with your right. It will spring out, when released, to an easy fit on the rod. Touch both ends on your emery-wheel, or file them, so that they are





Section of regulator

squared off. The spring should be a good 1 in. long when uncompressed. See that both port-face and valve are absolutely clean, then put a spot of cylinder-oil between them when assembling; put the spring on the regulator-rod, insert in barrel, put in the end plug, and secure it from coming out by a couple of 8-B.A. counter-sunk brass screws put through the barrel into the plug, as shown in the longitudinal section.

Connecting-tube and Gland Fitting

The regulator assembly is connected to the gland fitting on the backhead by a piece of $\frac{3}{8}$-in. copper or brass tube $6\frac{13}{16}$ in. overall length. Screw one end $\frac{3}{8}$ in. by 40 for $\frac{1}{4}$ in. length, and the other same pitch for $\frac{3}{16}$ in. length; then screw the longer end into the plug in the regulator body, the rod passing through it.

If a casting isn't available for the gland fitting, or stuffing-box, chuck a piece of 1-in. round brass rod in the three-jaw. Face the end, centre, drill about $\frac{3}{4}$ in. depth with No. 21 drill, open out to $\frac{3}{16}$ in. depth with 11/32-in. drill, and tap $\frac{3}{8}$ in. by 40. Turn down $\frac{1}{2}$ in. of the outside to $\frac{5}{8}$ in. diameter, and part off at a full $\frac{11}{16}$ in. from the end. Reverse in chuck, face the end, and cut back the flange to $\frac{1}{8}$ in. in thickness, leaving a slight projection in the centre, as shown in the

longitudinal section, for sake of appearance. Open out the hole for $\frac{3}{8}$ in. depth with letter J or 9/32-in. drill, and tap $\frac{5}{16}$ in. by 32. Drill six holes in the flange with No. 40 drill, for fixing-screws, same as a cylinder cover. Make a gland from $\frac{7}{16}$-in. round rod, same as piston-glands, but drilled No. 21. Screw this completed gadget on to the end of the connecting-tube, so that the distance between it and the regulator-barrel is $6\frac{3}{8}$ in., as shown.

On the centre-line of the backhead, $\frac{5}{8}$ in. from top of wrapper, drill a $\frac{1}{8}$-in. pilot hole, and open it out by stages to $\frac{5}{8}$ in. diameter. If you try to drill it full size at one go, you'll get a polysided hole; I usually finish mine with a reamer. The plate around the hole must be perfectly flat and smooth; judicious use of a file will do the needful. Cut a piece of $\frac{1}{4}$-in. copper tube, about 20-gauge, to $2\frac{7}{8}$ in. length, screw one end $\frac{1}{4}$ in. by 40 for $\frac{3}{8}$ in. length and the other end for $\frac{1}{4}$ in. length. Screw the latter end into the regulator, with a smear of plumbers' jointing on the threads. Poke the whole box of tricks through the hole in the backhead, and wangle the end of the $\frac{1}{4}$-in. pipe through the $\frac{3}{8}$-in. tapped hole in the smokebox tubeplate. Cut a piece of $\frac{1}{4}$-in. tube $1\frac{1}{4}$ in. long, put a few threads, $\frac{1}{4}$ in. by 40, on the end, and screw it into the hole in the top of the regulator barrel. When this merchant stands vertically in the dome hole, the regulator is adjusted O.K. and you can go ahead and drill and tap the backhead for fixing-screws, making countersinks on the backhead with a No. 40 drill put through the holes in the flange. Follow with No. 48, and tap 3/32 in. or 7-B.A. Unscrew the vertical pipe, take the whole doings out, put a Hallite or similar jointing gasket, cut from 1/64-in. material, over the boss of the flange fitting, and replace. The flange is secured to the backhead by 3/32-in. or 7-B.A. brass round-head screws $\frac{3}{8}$ in. long, the gasket preventing any leakage, and the vertical steam-pipe can then be replaced "for keeps." The dome can also be screwed down with a similar gasket between the contact faces. Pack the regulator gland with a few strands of graphited yarn, and fit a handle. This can be either as shown, or your own pet pattern.

To make the one illustrated, file it from a bit of $\frac{1}{16}$-in. by $\frac{3}{8}$-in. steel strip, to the same shape as the arms on the weighbar shaft, silver-soldering a boss on the larger end and in the same manner, which is first drilled and then filed square, to fit the square on the regulator-rod. Turn the grip from a bit of $\frac{1}{8}$-in. round steel held in three-jaw, and form a 3/32-in. pip on the end, which is driven through a 3/32-in. hole drilled in the narrow end of the handle. The whole issue is secured to the rod by a nut as shown. Be careful to file the square hole in the boss, so that when the regulator is shut, the handle is in the position of the clock-hands at 2.10. Move anti-clockwise to open the regulator.

Steam Flange and Wet Header

Chuck a bit of $\frac{7}{8}$-in. round rod in the three-jaw; face, centre, drill $\frac{5}{8}$ in. depth with 7/32-in. drill, and tap $\frac{1}{4}$ in. by 40. Turn down $\frac{3}{8}$ in. of the outside to $\frac{5}{8}$ in. diameter; further reduce $\frac{1}{4}$ in. to $\frac{3}{8}$ in. diameter, and screw $\frac{3}{8}$ in. by 40. Part-off at a full $\frac{1}{2}$ in. from the end; reverse in chuck, and take a truing-up skim off the face. Put a smear of plumbers' jointing on the threads, and screw the fitting on to the end of the steam-pipe sticking through the hole in smokebox tubeplate. The outer threads will engage with the tapped hole; and when right home, the whole lot will make a perfectly solid and steam tight joint. Hexagon rod may be used if preferred, as it is easier to screw home; I use it if I have any the right size, otherwise I file a couple of spanner flats each side of the flange.

Chuck the rod again; face, centre, and drill 7/32 in. for $\frac{5}{16}$ in. depth. Part-off $\frac{3}{8}$ in. from the end. Drill two $\frac{1}{4}$-in. holes in the edge, as indicated for the steam-pipes in the end view, and four No. 40 holes for the fixing-screws shown. It doesn't matter if the bottom screw-hole pierces the pipe holes; nothing will escape when the whole lot is assembled. For the water-tube boiler, drill only one hole in the edge.

Superheater

The elements are made from $\frac{1}{4}$ in. by 20 gauge copper tube. Cut two pieces $7\frac{1}{2}$ in. long, one $6\frac{1}{2}$ in. and one 8 in. The return bends are made from little blocks of copper $\frac{5}{8}$ in. square and $\frac{3}{8}$ in. thick. On one edge make two centre-pops $\frac{5}{16}$ in. apart, and drill in for $\frac{1}{2}$ in. depth with letter "D" drill if you have one; if not, use $\frac{1}{4}$-in. drill. The holes are drilled slightly on the slant, so that they break into each other just inside the block. Put a $7\frac{1}{2}$-in. and $6\frac{1}{2}$-in. tube in one, and a $7\frac{1}{2}$-in. and 8-in. in the other, and braze them in, using either brass wire as a brazing material, or Sifbronze No. 1; *don't* use silver-solder for this job, it is too near the fire. Soften the other ends of the tubes at the same heating; after quenching in pickle, and washing off, bend the main part of the tubes parallel to each other, as shown in the illustration, and the ends of the $7\frac{1}{2}$-in. tubes upwards. The $6\frac{1}{2}$-in. one is left straight, and the 8-in. one bent horizontally, as shown in the plan-view. Round off the ends of the block bends as shown, which will prevent "bird's-nesting" of cinders.

A tee-piece takes the place of a hot header, and this may be either a little casting or filed up from a bit of copper, like the return bends; or a bit of brass bar would do. You needn't be particular about the outside shape; Inspector Meticulous never travels in the smokebox of a locomotive! It is drilled either with letter "D" or $\frac{1}{4}$-in. drill, and the lower pipes fitted into it as shown in the plan-view; the two upper pipes are fitted into the diagonal holes in the wet header. In the outer end of the tee, fit a piece of $\frac{1}{4}$-in. pipe about $2\frac{1}{2}$ in. long, with a $\frac{3}{8}$-in. by 26 union-nut and cone on the other end. All the joints—wet header, tee, and union cone—can then be silver-soldered at one heat. Silver-solder is O.K. for the joints in the smokebox, as they are well away from the fire.

After pickling and washing off, the superheater can be fitted; put the elements in the tubes, bending the diagonal tubes if necessary, so that the elements come nicely in the middle of the flues, and the wet header lines up with the flange on the smokebox tubeplate. Hold it temporarily in position; poke the No. 40 drill through the screw-holes in the wet header, making counter-

sinks on the flange, follow up with No. 48, and tap 3/32-in. or 7-B.A. Ordinary cheese-head steel screws are used for fixing, and a 1/64-in. Hallite or similar gasket is placed between the contact faces. The union extension-pipe beyond the tee may be bent roughly into a swan-neck, to keep it out of the way whilst the rest of the blobs and gadgets are being fitted to the boiler ; you cannot get it exactly to the right shape until the boiler is finally erected on the chassis. The superheater for the water-tube boiler is a plain loop of $\frac{1}{4}$-in. pipe running from the wet header, *via* the firebox casing, to the union fitting in the smokebox. It has no joints whatsoever.

Blower Pipe

This is not shown in the illustration. It is merely a 4-in. length of $\frac{1}{8}$-in. copper tube, one end of which is furnished with a $\frac{1}{4}$-in. by 40 union nut and cone, to screw on to the end of the thoroughfare nipple on the smokebox tubeplate. The other end carries a weeny edition of the blast-nozzle, made from $\frac{3}{16}$-in. hexagon brass rod and drilled No. 70. It may be screwed or silver-soldered to the blower-pipe, just as you fancy. The pipe is bent into an inverted swan-neck, and the tiny nozzle set alongside its more hefty relative—" mother and baby "—so that the steam from it blows up the chimney. " Ma " looks after the job of keeping the home fires burning whilst the engine is running, and " baby's " gentle breath keeps them from going out whilst the engine is standing. You hear a lot of tales about engines working without a blower. Beginners may be interested to know that *on modern full-sized locomotives with short chimneys, there is no natural draught.* Several enginemen have received fatal burns through not putting the blower on before shutting off steam. The late King Boris of Bulgaria once took a train to its destination after an accident of this kind. Many people reckon that if he had " turned in " the throne and stuck to the footplate, he would still be alive, happy and jolly. It's a funny world! Mr. Chifley, the Australian Premier, was once an engine-driver, so Australian enginemen should have a good friend " upstairs " !

Safety-valve

The safety-valve is a plain ball non-pop of ample capacity to relieve the boiler. To make it, chuck a piece of $\frac{5}{8}$-in. hexagon rod—bronze if you can get it ; brass if not—face the end, and turn down $\frac{5}{8}$-in. length to $\frac{1}{2}$ in. diameter. Centre, drill down $1\frac{1}{4}$ in. depth with 13/64-in. drill, open out with letter " R " or 11/32-in. drill to $\frac{5}{8}$ in. depth, and bottom with a D-bit to $\frac{3}{4}$ in. depth. Tap the upper part $\frac{3}{8}$ in. by 32, and part-off at $1\frac{1}{8}$ in. from the end. Reverse in chuck, gripping by turned part ; turn down $\frac{5}{16}$ in. of the end to $\frac{3}{8}$ in. diameter, and screw $\frac{3}{8}$ in. by 26. Poke a 7/32-in. parallel reamer through the remains of the 13/64-in. hole.

For the nipple, chuck a piece of $\frac{3}{8}$-in. round rod in three-jaw ; face, centre, and drill No. 30 for about $\frac{1}{4}$ in. depth. Screw the outside $\frac{3}{8}$ in. by 32, and part-off a $\frac{3}{16}$-in. slice. File or mill two nicks in the edge, as shown in the plan-sketch. For the cup and spindle, chuck a piece of $\frac{1}{4}$-in. rod in three-jaw ; turn down $\frac{11}{16}$ in. length to $\frac{1}{8}$ in. diameter, an easy sliding fit for the hole in the nipple. Part-off at $\frac{1}{8}$ in. from the shoulder ; reverse in chuck, make a shallow centre, and open it to a full countersink with a $\frac{1}{4}$-in. drill, as shown in the section.

Seat a $\frac{1}{4}$-in. rustless-steel ball on the hole by the usual hammer-and-brass-rod wheeze, and wind up a spring from 22-gauge tinned steel wire, as described for the regulator, squaring off the ends in the same manner. Assemble as shown ; the spring should just start to compress when the nipple has entered about one thread. The valve is adjusted, on the boiler, to blow off at 80 lb. gauge pressure. Next job, backhead fittings.

For the Bookshelf

Petrol-engined Model Aircraft, by Lieut.-Col. C. E. Bowden, A.I.Mech.E. (London : Percival Marshall & Co. Ltd.). Price 7s. 6d. net.

Written by an inveterate enthusiast, an indefatigable experimenter, and one who has amassed a wealth of practical knowledge of the design, building and flying of petrol-engined model aircraft, this book is at once authoritative and instructive. Progress in the design and construction of miniature petrol engines has been so rapid in recent times, that the problem of equipping a model aeroplane with an efficient and reliable engine has now largely disappeared. Today, the question resolves itself more into discovering the best combination of engine and 'plane which will give the desired results ; and this book is full of information and suggestions born of actual experience. Mr. C. R. Jeffries has contributed an interesting and useful chapter on Radio Control, with excellent advice based on his own experiences during war-time experiments. The control of various kinds of moving models by radio is a fascinating field to explore, and much has already been done ; but it is subject to difficulties arising from regulations governing the selection and use of short wave-lengths. Colonel Bowden's book, however, should find a ready sale among all aeromodellers who would wish to apply the latest developments in petrol-driven models.

" OO " Gauge Layout and Design, by Ernest F. Carter (London : Percival Marshall & Co. Ltd.). Price 3s. 6d.

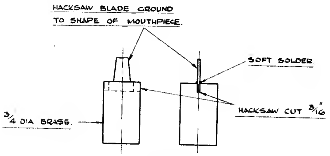
For those whose interest lies in planning layouts for miniature electrically-operated railways, here is a handbook of upwards of 100 pages containing practical guidance on how to approach the matter from first principles. The author's chief concern is to impress upon his readers the importance of following prototype practice implicitly and to adopt it according to the limitations of the space available for the miniature layout. Such other matters as station layouts, junctions, sidings of all kinds, locomotive depots, bridges, tunnels and so on, are dealt with concisely and lucidly. The book is illustrated by numerous typical diagrams as well as several photographs of prototype features relevant to the subject.

REPAIRING BROKEN PIPE STEMS

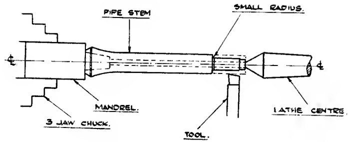
I HAVE no doubt that many readers are pipe smokers, who at one time or another have snapped their pipe stems. Difficulty in repairing often arises, due to the fact that they cannot hold the stem in the three-jaw chuck, as the mouth-piece will not go in the mandrel, and also the taper on the stem does not allow sufficient grip.

My friend and I have had about six pipes to repair, and as my lathe is very small, namely, $1\frac{5}{8}$ in., a mandrel had to be made, as shown in the sketch. The drawing is self-explanatory, but there are one or two points to note.

(1) The hack-saw cut is best done by drilling a small hole and then following down with the saw. (2) The piece of hacksaw blade must be ground both sides so as to remove the scale for soldering. (3) The hacksaw blade can be made any shape required to suit the pipe mouthpiece, but this is best done after it has been soldered into the brass mandrel. (4) In turning the spigot leave a small radius on the stem as illustrated, this will help to strengthen it.



Turning mandrel



Method of mounting in lathe

I have found this mandrel most useful, as it can be used for any straight stem with a slot in the mouthpiece and can be removed from the lathe with ease for checking purposes.

—R. STEER

L.S.W.R. No. 592

(*Continued from page* 66)

such as the removal of the splashers over the leading wheels of the bogie, the abolition of tail-rods forward of the pistons and the substitution of double-slide crossheads for the original single ones.

It is interesting to recall that Adams usually built his 4-4-0 passenger engines in two separate batches concurrently, one batch with 7 ft. 1 in. wheels for working to Bournemouth and east of Salisbury, and the other batch with 6 ft. 7 in. wheels for working from Salisbury to Exeter and in the south-western extremities of the system, where severe gradients are encountered. In all other respects, these concurrent batches of engines were similar.

No Adams 4-4-0 engines are now in service, but it is hoped that one, which is yet on the scrap sidings, may be saved from demolition and preserved.

A SIMPLE PASSENGER TRUCK

by C. Baker

FROM time to time, the less interesting jobs crop up and bring with them a certain amount of tedious or seemingly non-productive work which detracts from the main project in hand. The building of a passenger-hauling locomotive and, to a lesser extent, the laying of the track always command their fair share of the model maker's enthusiasm ; but neither acceleration but a handicap to a child who may want to take the truck on and off the track. Furthermore, simplicity, which is the essence of good design, had to be borne in mind becau-e it ensures speedy construction, and time between conceiving the idea and the approach of spring, when it was hoped that the weather might allow some outside activity, was short. No attempt

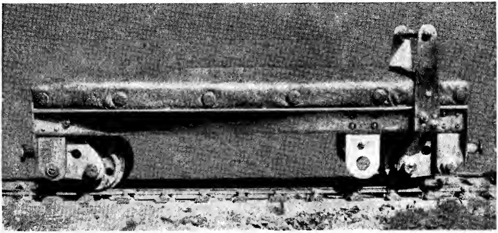


Fig. 1. *The finished truck*

of these can function without a means for carrying the driver and passengers, yet the trucks which perform this vital service on the railway are frequently considered as nothing more than troublesome, if necessary, evils which are better borrowed than made. Many types of trucks have been evolved and some good examples have been illustrated in THE MODEL ENGINEER from time to time ; but many of those actually running clearly show that what thought and care had gone into their design and construction does little credit to the masterpieces used to haul them.

The writer, confronted with the proposition of building a $2\frac{1}{2}$-in. gauge truck for one passenger, decided to tackle the job as a serious model in itself. The first essential was to consider the requirements that had to be met. The truck was to serve two main purposes, first, to carry one adult person in the normal course of its duties, and secondly, a child who would run it by gravity over an inclined portion of the railway when the more serious section of line was not working. The latter was anticipated to be a somewhat arduous service in which the truck would be subject to rough handling ; so a robust design of ample strength was called for yet one in which lightness had to be given its due consideration since dead weight is not only the enemy of at scale proportions or appearance were either necessary or possible, but their absence not only failed to detract from the interest of the job but proved a welcome change from strict scale model work and afforded an opportunity to build the truck on engineering lines unhampered by considerations of scale and realism.

Several materials were considered and the final choice was influenced partly by having obtained some odd pieces of aluminium alloy and partly by the suitability of such light alloys for strong, light-weight structures. Model makers might make more use of these alloys. Apart from the castings for small petrol engines and the frame of model cars, aluminium parts are not often found in the ordinary model maker's workshop ; yet such material is fairly easy to work, being strong and having a good appearance. Some care is necessary when filing it to keep the tool clean, since swarf has a most persistent habit of sticking to the file and tearing the work in consequence. Screwing and tapping also need more care than in the case with brass and steel, and a thought should be given to the possibility of corrosion. Pure aluminium and such as the silicon alloys are more or less immune from this tendency ; but the duralumin range is liable to corrode in a moist atmosphere, and by electrolytic action if the alloy comes into direct contact

with steel or brass. So, if no other protective treatment is provided, a coat of paint is necessary both on the main surface of the metal and on the bolts, brushes and so on.

The solebars of the truck are cut from 1 in. × 1 in. × $\frac{1}{8}$ in. extruded angle, $15\frac{1}{4}$ in. long, fitted with the horizontal flanges uppermost and facing outward to provide an overall width of $6\frac{3}{8}$ in. The ends of the top flanges are tapered off to give a semblance of "lines" to the job and to reduce the width of the headstocks to 5 in. These are cut from 16-s.w.g. light alloy sheet and are riveted to the solebars, with corner angles of the solebar section, by 3/32 in. snap-head aluminium rivets. The corner angles are $2\frac{5}{8}$ in. high and, since they are designed to carry the wheels, the solebar is consequently well above rail level.

The truck is suitable for both ground-level and raised tracks. For the former the seat should be fitted as high as practicable whilst in the latter case, a little extra height is no detriment. It was decided to fix the top of the seat at $4\frac{5}{8}$ in. above rail level and, allowing for the framework which is described later, the top of the solebar is $3\frac{1}{4}$ in. high. To suit footrests for both types of track, a length of 3/32 in. thick extruded angle drilled to take a $\frac{1}{2}$ in. diameter bar is riveted to each solebar with $\frac{1}{8}$ in. rivets. A straight length of light alloy tube as shown in Fig. 2 is used for ground-level tracks, and stirrups supported from it accommodate one's feet when travelling on the "high level."

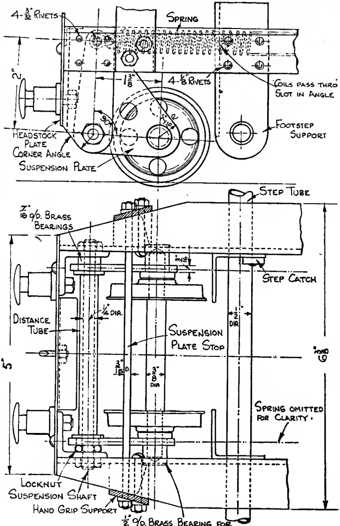


Fig. 3. Constructional details

At first, two four-wheeled bogies were considered; but since the truck was to carry only one passenger (and usually a very small one at that), the idea was abandoned in favour of simplicity and speed of construction. And even the four-wheeled design was cut with this end in view. Anybody with a drilling machine can drill a hole; but fitting sliding surfaces and individual springs is a bit more difficult and takes longer. Similarly, turning round bushes is easier than machining axle-boxes; so it was decided to adopt a wheel arrangement in which drilling and plain turning were the only machining operations.

The wheels are carried in a triangular-shaped light alloy suspension plates forming bell-cranks, the upper legs of which are connected to tension springs. The plates are pivoted about $\frac{1}{4}$ in. diameter mild-steel suspension shafts which pass through the bottom of each of the corner angles. Brass bearings are provided for the suspension shaft and the axle journals. The plates themselves are cut from $\frac{3}{16}$-in. light-alloy plate. The holes are drilled and reamed and the bushes turned to a press-fit, inserted by means of the vice. Steel bushes are used for the attachment of the springs, since these holes are much smaller and the bearing stresses correspondingly higher.

It will, of course, be argued that ball-races would be better for the wheels; and, whilst that point must be acceded, it may be pointed out, in reply, that a clearance-hole 1/64 in. over

Fig. 2. The baby takes a ride

$\frac{5}{16}$ in. diameter of the journal provides free running, and the plain bearings were easily and quickly made from material to hand.

A steel tension-spring composed of 32 coils of 16-s.w.g. wire wound to an outside diameter of $\frac{1}{2}$ in. is positioned inside each solebar. One end of each is secured directly with a small shackle at the top of the suspension-plate, as shown in Fig. 3, and the other connects by means of a length of 16-s.w.g. galvanised wire running along the inside of the solebar, straight on to the suspension-plate on the same side of the truck at the opposite end. The springing of the vehicle would be adequate if it were left like this; but the whole would be an unstable parallelogram free to rock about the wheels. So a connection to the underframe is necessary, and takes the usual form of a plate fitted at the centre of the spring. The footstep support-angles provide this connection and are conveniently placed to induce sufficient load into the half of the spring attached directly to the suspension-plate. The same load is applied to the other half by adjusting the length of the connecting wire. The spring is secured to the angle by threading it through a slot cut in the latter and turning it coil by coil, until half the spring is disposed equally on each side.

If the truck is overloaded the suspension-plates move until the upper parts touch the corner angles of the structure and so relieve the springs of any further loading, whilst a stop limiting the travel for the no-load condition, when the truck is off the track, is provided by a $\frac{3}{16}$ in. diameter bar fitted across the solebars. At one end of the vehicle the bar forms one of the attachments for each of two uprights which rise above the structure to carry a $\frac{1}{2}$ in. diameter turned light-alloy bar to form a handgrip.

The suspension-plates are pivoted about a $\frac{1}{4}$ in. diameter mild-steel shaft passing through the lower ends of each pair of corner angles. The shaft is held by a nut on each side of one angle but only on the outside of the opposite angle, the thickness of the nut being made up by using a wider bush in the latter case. The arrangement facilitates assembly and obviates the need for a screwed shaft, which would otherwise be necessary to assemble the second nut and would result in undesirable bearing on the thread. A distance-tube keeps the suspension-plates at the correct distance apart. Dummy steel buffers and a drawhook are fitted to each headstock.

The seat is an entirely separate unit. It was decided to equip the truck (or rather, car!) with first-class comfort, and an upholstered version was selected. The side and end members are of deal with intermediate transverse stiffeners, $\frac{1}{4}$ in. wide, of the same material, jointed and glued in the usual way. The top is covered with $\frac{1}{16}$-in. plywood glued and bradded to the framework, and this takes the "Kapok" which is used as filling. The seat is trimmed with brown leather cloth which folds under and is glued to the bottom surface. It is also secured along the two sides with brown upholsterers' studs, which match the material. The finished seat rests on the sole-

(Continued on next page)

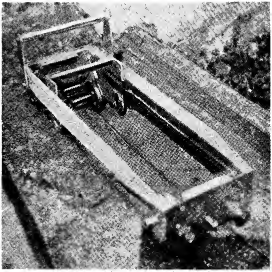
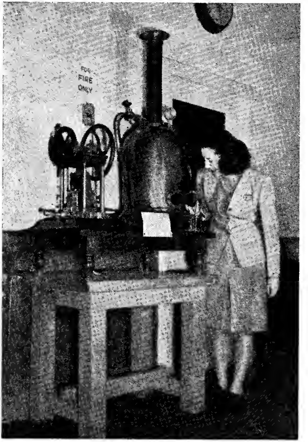


Fig. 4. The underframe before fitting the seat

An Old-Time Model

AN interesting example of the discovery of a forgotten model has reached us by the courtesy of Mr. Thomas Wayling of Ottowa. The steam engine and boiler shown in the accompanying photograph came to light recently when a number of war assets were being disposed of in Canada. The model itself is not a war asset but it was salvaged at Rideau Hall, the Governor-General's residence, where it had been for many years. It had evidently been brought out by an early Governor-General for some purpose or other and relegated to an outbuilding, where it remained in obscurity for many years.



Mr. Wayling says that no offers have yet been made for it, but it has aroused wide interest among engineers, and it seems probable that it will find its way into a national collection. He adds : " Canada has a national museum, but it is crammed with Eskimo and Indian stuff. We need a South Kensington Science Museum."

The model was brought to the notice of Mr. E. A. Allcut, Professor of Mechanical Engineering in the University of Toronto, and he writes :—

" From the photograph it is obvious that this is an oscillating cylinder engine, first made by Messrs. Maudslay and Field, and then by John Penn & Sons of London, England. It was designed for use with paddle-wheel steamers and was particularly convenient for use in shallow draft steamers as the elimination of the connecting-rod made the engine shorter and consequently the cylinder could be placed conveniently under the paddle-wheel shaft. They were designed for low steam pressures, not more than 30 lb. per square inch, and were mainly used on fast passenger steamers on short voyages where coal consumption was not of primary importance. This model is of considerable historic interest and should be preserved. We are arranging in, the extension to our Mechanical Building at the University of Toronto, an engineering museum in which engines and models of historic interest are to be placed. It is our hope that this will eventually grow into a sort of South Kensington Museum for the Dominion of Canada. I suggest, therefore, that unless you have other plans, this would be a convenient place in which to use and exhibit the model. It is of interest to note that the first design of an oscillating engine was made by Murdock (Messrs. Boulton & Watt) in 1785, but this model probably relates to the design of the early 1800's."

A Simple Passenger Truck

(*Continued from previous page*)

bars and on angles riveted to the headstocks, and it is held to each with No. 6 woodscrews inserted from the underside of the truck.

The appearance of the seat is enhanced by the bright finish of the alloy, all of which is buffed up. To retain the polish, it was given a coat of clear lacquer, and all the steel parts—wheels, axles, shafts, buffers and so on—are finished in signal-red which produces an attractive contrast. The underside of the seat is varnished.

The foregoing notes make no pretence at being working instructions for making a truck; personal requirements and tastes are too varied to consider a standard model.

HYDROFOIL BOATS

A new line for the model-maker

IN various shipping and model engineering exhibitions held recently we have been greatly interested in the Hydrofin invented by Mr. Christopher Hook.

This, as most of our readers are probably aware, is a new type of hydroplane, the hull of which is lifted clear of the water by means of automatically-controlled hydrofoils, thus reducing the friction through the water to an amount almost negligible, and consequently giving a greatly increased speed for a given expenditure of power at the airscrew.

New Principles

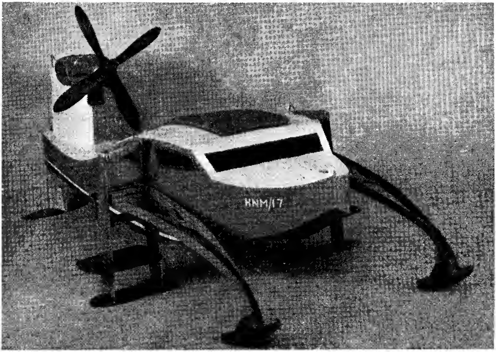
The principles involved are quite novel and are so much out of the common that we approached the inventor, who has very kindly supplied us with a *resume* of the considerations which led up to the invention, together with a diagram illustrating the basic principles and a very clear explanation of the diagram. These are reproduced herewith.

Historians in later years will certainly be astonished at the gap which separates the practical utilisation of the aerofoil from that of the hydrofoil. In truth, the latter presents technical difficulties to the solution of which only the present-day developments of the flying-boat have been able to point the way. In essence there is no difference between the two except, of course, the 815 times greater density which has the effect of very much reducing the surface as well as calling for minor differences in shape. But complications arise when it is required to add the dynamic hydrofoil as an adjunct to the static floating hull. This difficulty may be defined as follows :—

The Problem

Whereas a hull is a body which always displaces water and when plunged under the surface will always exert an upward lift, the hydrofoil, on the contrary, only exerts that lift if the angle of attack is correctly set. In fact, the lifting forces exerted may vary enormously and in rough water with any violent upset of longitudinal trim may even exert a downward pull capable of swamping the whole boat.

It is idle to maintain that a boat can be continually run at one designed longitudinal trim. This may be managed for a short time, but in a smallish craft even the movement of the passengers' weight may upset the whole applecart and a hydrofoil which engages on a downward rush is a highly dangerous instrument. These same snags can also appear in lateral movements



A model built for Government tests

and on the side of a wave or when the craft is upset for any other reason she may engage in a kind of wallow which may end up in a side slip. again with very unpleasant consequences.

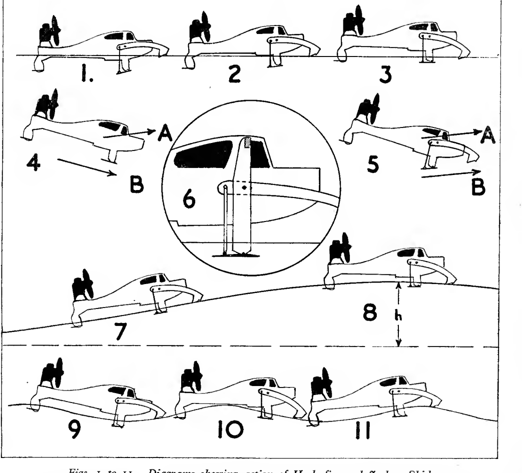
In aviation man has had the bird to copy and this has provided a guide which has never let him down. It is to be presumed that Nature must have made some unsuccessful designs and that these animals, being unable to fly, fell victims to beasts of prey and therefore that particular design was discontinued. But Nature has never produced either an airship or a hydrofoil boat, although the fish is somewhat like an airship floating in a heavier medium just as the hydrofoil is an aeroplane wing working in the same medium.

Comparison with the Aeroplane

In order to lift the hull entirely clear of the water it is, of course, necessary to provide a system of struts which transmit the forces from the hydrofoils to the craft itself. Just as in the aeroplane, every pound of weight is worth its weight in gold, since there is a very direct relationship between weight and thrust. But since the change of medium has permitted an enormous reduction in surface as well as rendering possible the rising operation at very low speed, it follows that considerable economies in weight become possible if the system is compared to aircraft design, and since these economies can be invested in payload, it follows that the economy of the system quoted in terms of tons of cargo per horse-power/hour and per mile is cheaper than can be the case in aviation. Since the craft no longer has to arrive at flying speed but can leave the water as soon as "finning" speed is reached, it follows that take-off is a much easier problem than with the flying boat.

Diagrams are here reproduced of the movements of the Hydrofin with particular reference to the jockey skid and the moving hydrofoil in waves of different sizes.

Fig. 1 shows the Hydrofin at rest in the floating position. Note that the jockey is high and the angle of attack of the main hydrofoil is therefore a large one.



Figs. 1 to 11. Diagrams showing action of Hydrofin and Jockey Skid

Fig. 2. The Hydrofin is moving forward and the lift provided by the planing bottom is assisted by the lift from the hydrofoils. Note that the jockey is coming down and the positive angle of attack of the main hydrofoil is being wiped off.

Fig. 3. The Hydrofin has now arrived at the running position and maintains a perfectly even keel both laterally and longitudinally. Any further rise would make the jockeys break surface and would call for a negative angle of attack, and this would immediately correct the tendency. Any tendency to sink would call for a positive angle of attack and thus the craft has come to a point of regime and cannot deviate from the line of travel. It will be noted that the tail is self-trimming, since the craft rises first at the bow. This produces a more positive angle of attack, but in general any rise or fall of the forward part is copied by the tail fin, which therefore requires no jockey mechanism.

The Hydrofin under electric power model in action

Without the Jockey Control

Fig. 4. Here is shown what happens to a hydrofoil boat not provided with jockey mechanism. It will be seen that as soon as the lateral trim is upset the hydrofoil must tend to travel in the direction B while the craft is required to travel in the direction A. If the craft should strike the water there would be opposition between these two forces which means that the hydrofoil becomes a menace and tends to make the craft dive into a wave.

In Fig. 5, a Hydrofin set in the same position shows no opposing tendencies, since with the high jockey engaging on the slope of the wave both hydrofoil and hull travel in the same direction.

The comparison between 4 and 5 can be put differently by explaining that the craft in Fig. 4 will wallow into a wave, due to the presence of the hydrofoil, while the craft in Fig. 5 will not.

Insert 6 shows the simple mechanism of jockey and hydrofoil magnified.

The Control Mechanism

Fig. 7. The Hydrofin is rising on a wave of height equal to the hull length multiplied by 0.57. It will be seen that, as the jockey is in a neutral position and the actual force required to lift the craft over the top of the wave is supplied by the wave itself, no extra demand is made on the motive power.

Fig. 8. A very slight negative angle starts the Hydrofin on the downward grade, and it will be seen that there is no difficulty in waves of this size.

Figs. 9, 10 and 11. These show the Hydrofin in waves of the most awkward height; that is to say, equal to about 0.14 of the hull length. In waves of this height the pitchingmovement is at its maximum and pointed wave crests may sometimes touch the hull at the step, but there is no violent impact and pounding is impossible. In waves of this size great speeds are not possible, and the craft may sometimes have to change course and / or reduce speed.

It will be noted that even in this case of most awkward size of wave the movement of the jockey does not exceed 18 degrees. In normal travel the movement is about 5 degrees ($2\frac{1}{2}$ degrees each side of normal.

The next step in Hydrofin design is to add the shock-absorbing device, and this will make travel still smoother.

The Use of Models

The idea was worked out and developed by means of models, and it appears to us that models of the craft in its present stage of development would provide endless interest and scope both in their design and construction and later in trying them out on the water. We reproduce a photograph showing a Hydrofin model actually in operation. Owing to the high speed developed, they must be run around a pole and would thus have a special interest for builders of speedboats. The power unit in the model shown is a small electric motor. Other models are petrol driven. The close-up photograph of the Farnborough test model itself gives a good idea of its construction. Further particulars and drawings may be obtained from the makers, who frequently advertise in our pages.

It might be mentioned in passing that, during the recent model engineering Exhibition held at Plymouth, a Hydrofin Club was formed with the express purpose of building and racing this type of model.

The makers have a full-size craft in operation at Cowes, and a passenger-carrying Hydrofin is being designed which is to be powered by an Armstrong-Siddeley Cheetah engine.

Editor's Correspondence

Lathe Speeds

DEAR SIR,—I would like to express through your columns a plea to lathe manufacturers that they should provide a considerably greater speed range on their 3-in. to 4½-in. models, than is usual at present.

Model engineers are not usually able to afford a watchmaker's lathe, specially for small jobs, and the one and only 3-in. or 4½-in. lathe is required to do everything from truing its own face-plate, to turning carburettor needles and injector cones.

My own 4-in. lathe is at present fitted with a 3-step cone pulley for 1-in. belts, and I have recently designed a 5-step V-pulley to take its place. This with a 7.6 back gear, will give a continuous geometric series of speeds from 25 r.p.m. to 960 r.p.m. by 50 per cent. increments.

Various friends with whom I have discussed this proposal have said "What on earth do you want ten speeds for?"

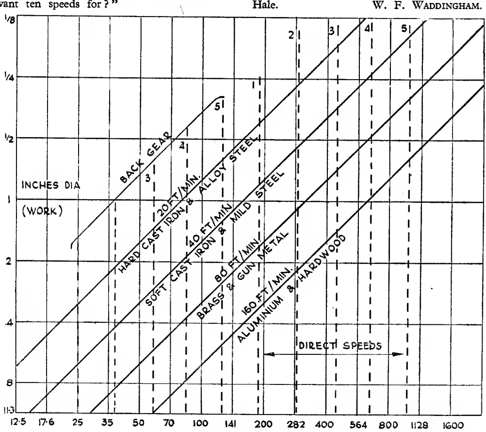
The chart reproduced herewith plotted to square law co-ordination supplies an adequate answer, and is designed to give a rapid indication of the most suitable speed ratio to use for any particular material and work diameter.

The cutting speeds recommended are by no means the maximum possible for a given tool life, but are those which I have found satisfactory on my own lathe using high speed tools for steel and cast-iron, and carbon steel tools on non-ferrous materials.

In case other readers are interested in this chart, I would add that it is not difficult to plot; and, provided the cutting speeds chosen are multiples of one another, only two points need be calculated for each of the first two cutting speeds lines plotted, and the remaining cutting speed lines follow at equal intervals.

Yours faithfully,

Hale. W. F. WADDINGHAM.



Precautions for Handling Ether

DEAR SIR,—The author of an article in the June 12th issue of THE MODEL ENGINEER discusses various grades of Ether. Apparently B.S.S. Grade of S.G.O.720 contains traces of sulphuric acid. The British Pharmacopoeia (B.P.) lists two "Ethers" *viz.* "Ether" and "Anaesthetic Ether," both these substances should be free from acid and I should imagine that for the author's purpose "Ether" B.P. should be satisfactory.

Should he wish to remove acid from his B.S.S. ether, I would suggest that he shakes his ether up with a quarter of its volume of lime water (using a finger to close the mouth of the bottle in preference to a stopper). On standing the mixture will separate into two layers, the upper of which will be the ether. This may be poured off and filtered if necessary. Any water which the ether may have dissolved in the process could be removed by adding a small quantity of anhydrous calcium chloride to the separated ether, and allowing to stand for an hour or two.

I trust that the above information will be of use to the author but I would like to warn him and other users of ether that it is very dangerous to handle. One of your contributors recently did mention about the heaviness of its vapour which is highly inflammable. It should be pointed out that in a chemical laboratory where a fire is not of great consequence elaborate precautions are taken as a matter of course during the handling of ether. Another very serious consideration is that ether on being kept in contact with air is very liable to form peroxides which are highly explosive.

If ether must be used, buy small quantities at a time from a supplier who has a good turnover of his stock and keep it in a bottle which it fills to the top, so excluding air. If this is done there should not be any trouble from peroxides.

Finally, when handling ether, make sure that no naked flames or even the heated elements of electric fires are near. Preferably work in the open air. Ether should be stored in a cool place and protected from light.

Yours faithfully,

Edinburgh. J. OWEN DAWSON, B.Sc. Ph.C.

Fire Pumps and Boilers

DEAR SIR,—With reference to Mr. Hart's comments regarding my model fire engine and the article which appeared in THE MODEL ENGINEER of February 6th last. I referred to it as being a bucket and plunger type pump, and I was under the impression from the description of the action and the drawings that the purpose of the plunger was clear enough.

I would point out that in the case of the full-sized engine it had an 8 in. dia. bucket and a 6 in. dia. plunger. Now by making comparisons of the areas I find, after much hard thinking, that 8 in. dia. gives 50.26 sq. in. and 6 in. dia. 28.27 sq. in., giving a ratio of 1.78 to 1. These sizes can be verified from the Science Museum who kindly supplied me with the data. In the model the bucket diameter is 1.375 in. while the plunger is 1 in. This gives us 1.375 in. dia. and 1.48 sq. in. area and 1 in. 0.7854 sq. in. Ratio 1.88 to 1. Therefore the model is near enough to scale. All this I was aware of at the time of construction, but I did not mention it in the article, which was intended for general interest.

The original boilers of these machines had 70 cross-tubes, not four, as fitted to the model. But here again let us make a comparison; the model is one-sixth full size, the diameter of the tubes would have been in the region of, let us say, 1 in. (A modern water-tube boiler has tubes about $1\frac{1}{2}$ in. diameter, and these boilers are giants in comparison; therefore, after allowing the reduced volume per lb. of steam for the high pressures that these boilers work at, compared with the low pressures of a fire-engine boiler, 1 in. diameter is to me on the generous side), therefore, 1/6 in. diameter would be a bit small for a working model, as Mr. Hart will appreciate. You can't scale water, soot and steam with 70 tubes in such a small space. Or, in other words, if you want the best results, don't try and crowd out Dame Nature. I am quite well aware that the upper part of the boiler should be bolted to the lower, but as those angle "irons" are made of $\frac{1}{16}$-in. thick copper, machining the faces and making joints would not prove as satisfactory as a riveted joint. These deflections one had to make owing to the scarcity of materials available at the time of building, as gunmetal castings for the rings were unobtainable.

I trust that Mr. Hart's article will be of interest to readers, but to myself it conveys no more than I was aware of over fifty years ago. He refers to the slide or Scotch crank. This type of crank was more generally fitted to the engines made by Messrs. Merryweather. I remember as a boy, about sixty years ago, I often attended the competitions of fire-brigades held annually on Ealing Common, and I was struck with the comparatively smooth working of the Shand Mason type fitted with two piston-rods as compared with Merryweather's equipped with slide cranks. These set up an infernal rattle and clatter; it seemed impossible to keep them silent. Slide cranks are my pet abomination, partly for this reason.

I knew Shand Mason's works at Blackfriars well, and it was a sad day to me when they packed up business. At the auction sale, a small beam-engine which was used for driving lathes, etc., in their workshops was sold for £5, and an old fire-engine fetched a like amount. How does this compare with the prices fetched by models to-day? Well, times change, but looking back over a long life, in my opinion, the old days were the better.

Yours faithfully,

Snaresbrook. E.18. H. S. GOODMAN.

Petrol Blow-Lamps

DEAR SIR,—*Re* your queriest L.T. (Shallufa) No. 8031 in the issue of June 26th who is having trouble with his petrol blow-lamp, might I suggest that he uses *brass* tubing for his vaporizing coil, not copper.

Brass does not scale like copper and will last for years, as I know from experience, having used my lamp with brass vaporizers for over ten years with only occasional choking, and it really has had some usage.

Yours faithfully,

Catford. J. H. JEPSOM.